Project # 131

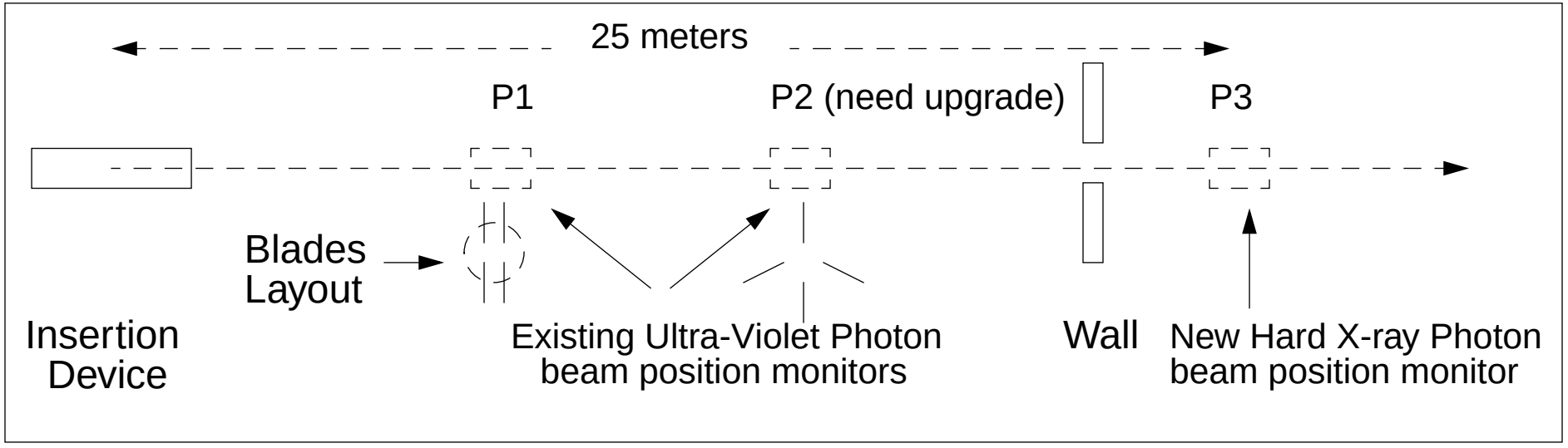
X-ray Beam Position Monitor System (BPM) Enhancement
SR Diagnostics Upgrade

Om Singh
Diagnostics Group
APS Operations Division

Project #131: Storage Ring X-ray Beam Position Monitor System (BPM) Enhancement

Objective: ***Eliminate the need for APS ID beamline steering requests***
For FY05:
i) Develop first production unit “gold-standard” white x-ray bpm (P3)
ii) Initiate incremental upgrade of existing ultraviolet photon bpms (P2)

Background:
This is a new high priority initiative - at least two fiscal years will be required to meet the objective. Development of the white x-ray bpm will leverage off of earlier work.*



*R. Alkire, G. Rosenbaum**, G. Evans, J. Synchrotron Rad. (2000) **7**, 61-68

Justification:

During machine startup and periodically during a run, APS users spend significant time performing beam alignment activities. This is a waste of time, and therefore money. By one estimate**, beam time can be valued at $500 per hour for a single beamline. Multiple shifts are generally used each run on every beamline performing alignment activities.

Existing ID photon beam position monitor readings are suspect, especially when comparing readings taken at different insertion device gap settings. The hard x-ray beam size is much smaller than the soft ultraviolet halo detected by existing photon beam position monitors. Detecting these hard x-rays directly provides the best hope of obtaining the “right” answer, since this is what the users are most interested in.

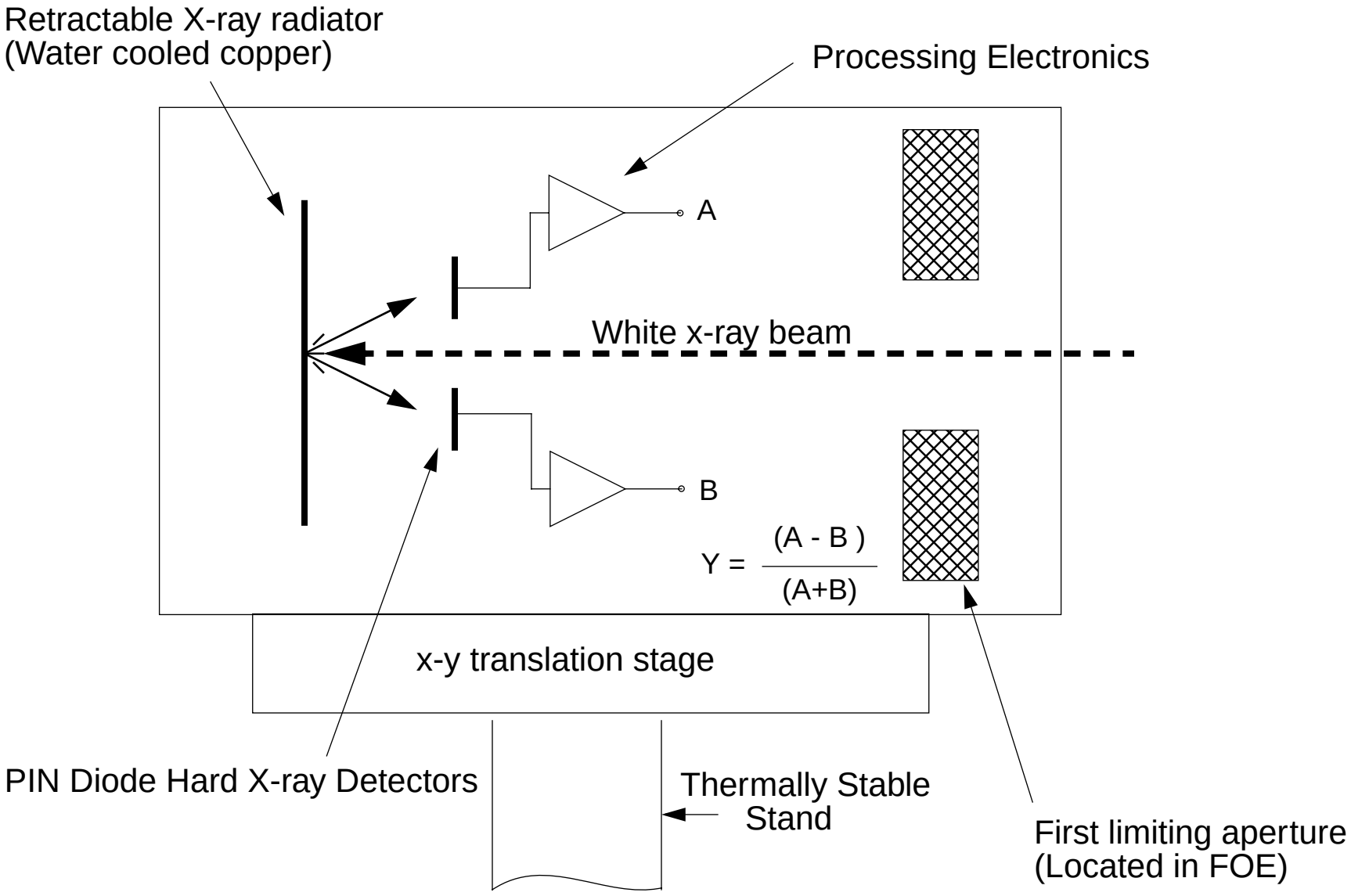
Consequence:

Assuming the elimination of 1 alignment shift per run per beamline at $500 per hour for 20 insertion device beamlines, a total of a $250k per year of lost science can be recovered.

New experiments e.g. nanoprobes will require a new level of beam stabilization and control. Investment in beam position diagnostics further down the beamline will facilitate these efforts.

Cost: FY05 Requested Funds: $118K
FY05 Cost Including All Efforts: $240K
Cost-to-complete (FY06/07): $30-$40k per beamline for both bpms.
- estimate, scope, schedule to be refined in FY05

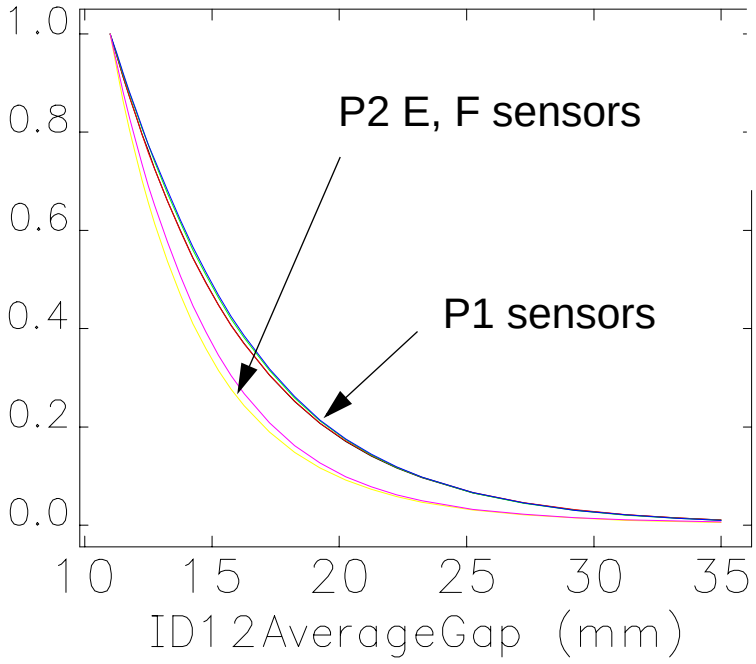
White X-ray Beam Position Monitor Concept (P3)



Upgrade to existing “P2” UV-sensitive photon bpm’s

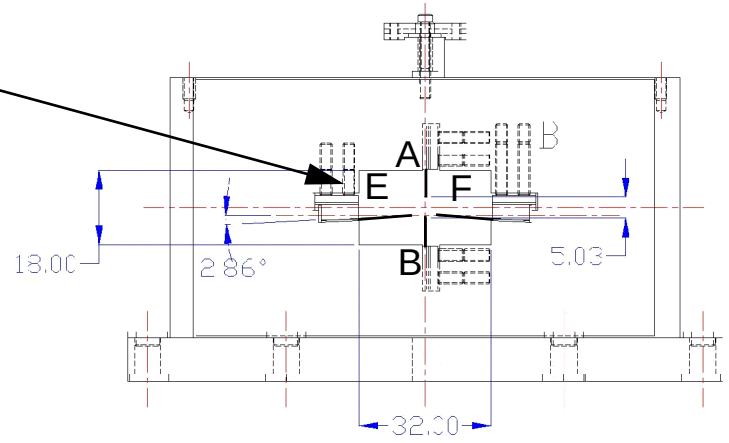
Large stray radiation background signal levels for “E” and “F” sensors dominated by bending magnet radiation located near accelerator midplane.

Normalized Signal Strength vs. Gap

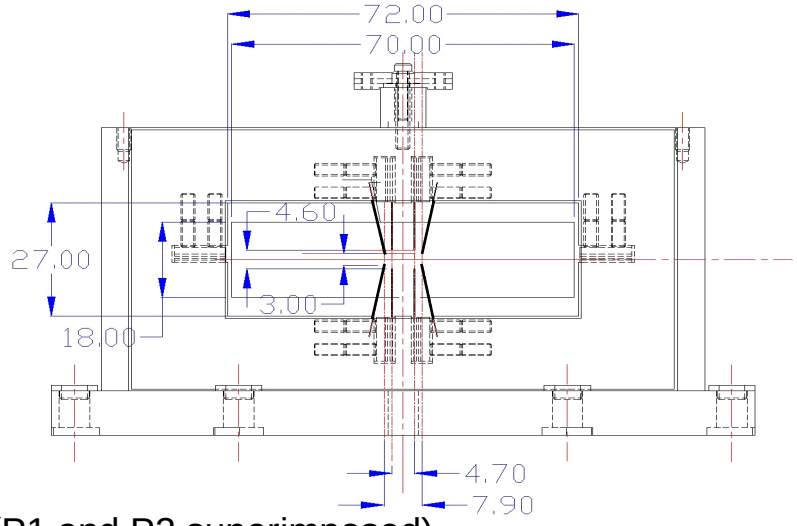


Performance at large gap compromised by low signal levels

Old P2 Design



Proposed Replacement (D. Shu)



(P1 and P2 superimposed)

Project # 131

X-ray Beam Position Monitor System (BPM) Enhancement
SR Diagnostics Upgrade

FY05 cost breakdown (untaxed)
==========

P3 Prototype unit $15K
P3 1st Production unit $66K

P2 1st Production unit $24K

FY06/07 production units
==========

P3 production units $20-30 K per unit
P2 production units $7-10K per unit (20 maximum)